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THE COUNTRY CODE AND NUMBER OF YOUR PRIORITY APPLICATION, TO BE USED FOR FILING ABROAD UNDER THE PARIS CONVENTION, IS US62/920,613



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PROVISIONAL APPLICATION FOR PATENT COVER SHEET – Page 1 of 2

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c).

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INVENTOR(S)		
Given Name (first and middle [if any])	Family Name or Surname	Residence (City and either State or Foreign Country)
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Additional inventors are being named on the _____ separately numbered sheets attached hereto.

TITLE OF THE INVENTION (500 characters max):
Dye Sublimation Ink Composition and Process for use with Pad Printers

Direct all correspondence to: **CORRESPONDENCE ADDRESS**

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ENCLOSED APPLICATION PARTS (check all that apply)

Application Data Sheet. See 37 CFR 1.76. CD(s), Number of CDs _____

Drawing(s) Number of Sheets _____ Other (specify) _____

Specification (e.g., description of the invention) Number of Pages _____

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METHOD OF PAYMENT OF THE FILING FEE AND APPLICATION SIZE FEE FOR THIS PROVISIONAL APPLICATION FOR PATENT

Applicant asserts small entity status. See 37 CFR 1.27.

Applicant certifies micro entity status. See 37 CFR 1.29. Applicant must attach form PTO/SB/15A or B or equivalent.

A check or money order made payable to the *Director of the United States Patent and Trademark Office* is enclosed to cover the filing fee and application size fee (if applicable).

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PROVISIONAL APPLICATION FOR PATENT COVER SHEET – Page 2 of 2

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government. (NOTE: Providing this information on a provisional cover sheet, such as this Provisional Application for Patent Cover Sheet (Form PTO/SB/16), does not satisfy the requirement of 35 U.S.C. 202(c)(6), which requires that the *specification* contain a statement specifying that the invention was made with Government support and that the Government has certain rights in the invention.)

 No. Yes, the invention was made by an agency of the U.S. Government. The U.S. Government agency name is: Yes, the invention was made under a contract with an agency of the U.S. Government.

The contract number is: _____

The U.S. Government agency name is: _____

In accordance with 35 U.S.C. 202(c)(6) and 37 CFR 401.14(f)(4), the specifications of any United States patent applications and any patent issuing thereon covering the invention, including the enclosed provisional application, must state the following:

“This invention was made with government support under [IDENTIFY THE CONTRACT] awarded by [IDENTIFY THE FEDERAL AGENCY]. The government has certain rights in the invention.”

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SIGNATURE  DATE 5/6/19TYPED OR PRINTED NAME Tonya Tremitiere REGISTRATION NO. _____
(if appropriate)TELEPHONE 941-315-6320 DOCKET NUMBER _____

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7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
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Dye Sublimation Ink Composition and Process for use with Pad Printers

What is claimed is a non-drying, environmentally friendly disperse dye sublimation ink composition to be used in pad printers where the sublimation ink is imaged onto an intermediate substrate and the dye transferred to a dye-receptive surface using a suitable combination of heat, pressure and time. Such an image would appear as a reverse image. Alternatively, the ink could be deposited onto a secondary surface such that the image is reversed, and that reversed image transferred to a final surface such that the image would appear right-side. The composition comprised from about 50 to 90% water, from about 5 to 45% water miscible solvent, from about 2 to 20% disperse dye particles of approximately 200 nm or smaller, from 0.1 to 5% pigment dispersant and optionally additional components such as biocides, surfactants, viscosity adjustors, and UV light stabilizers.

Background:

Disperse dye inks have been known for at least 75 years. For example, U.S. 4,062,644 issued to Graphic Magicians discloses a transfer ink to be used with a felt tip pen. U.S. 4,082,467 to Kaplan also discloses a felt-tip marker pen and dye dispersion of vaporizable disperse dyes. In this example the dye is first dispersed with linseed oil and includes 40-50% of a soluble resin such as hydrogenated resin. This dispersion is then diluted with water, additional soluble resin and 80-90% of a polyalcohol. U.S. 4,211,528 also discloses use of sublimable disperse dyes in felt tip marker pens. In this example the inventor formulates a solution rather than a dispersion of the disperse dye particles. This was accomplished by use of chlorinated solvents which are environmentally unfriendly and would not be accepted in today's commercial market.

Disperse dye-based sublimation ink compositions are known in the literature, although not for stamp pad use. U.S. 4,725,849 to Koike describes a disperse dye composition for inkjet printing directly onto cloth that has been treated with a hydrophilic resin. The particular ink compositions contained 20% or higher concentrations of solvent and this would be undesirable for stamp pads. U.S. 5,642,141 to Hale describes a process for inkjet printing heat activated inks onto an intermediate substrate and subsequently heat transferring that ink to a substrate similar to the Graphic Magicians earlier patent. The '141 patent claims a broad range of ink compositions suitable for the inkjet printing but interestingly does not reference the earlier '849 patent that includes the same compositions. There are numerous additional inkjet ink patents included in the reference material where the claims relate to disperse dye compositions with varying types of surfactants, dispersants or solvents.

Sublimable dye-based ink compositions mentioned in the disclosed patents each suffer from a number of disadvantages if the ink is to be used in a consumer product such as a stamp pad. First, they must be designed to be toxicologically and environmentally safe, be non-irritant, and preferably provide a negative Ames test. The Ames test was developed by Professor Bruce Ames in the 70's as a convenient means of determining if a chemical poses a potential mutagenic hazard. The test uses different strains of bacteria

to predict probabilities of a compound to cause DNA mutations. Although a positive Ames test in itself does not mean that an ink is necessarily harmful to humans, it can create a negative perception by users of such a product. A good reference to Ames test and imaging materials can be found in Peter Gregory's publication *Chemistry and Technology of Printing and Imaging Systems*. Some disperse dyes mentioned in earlier patents are not Ames negative. A second issue is the use of solvents and chemicals that are now considered either toxic or environmentally unfriendly. A third issue is the stability of the ink compositions. It is difficult to maintain long-term dispersion of pigment-based disperse dye sublimation inks. If the dye particles aggregate the inks will not print consistently. A fourth issue relates to maintaining an environmentally friendly solvent mixture that will not dry prematurely. A fifth issue is formulating an ink with the proper viscosity such that the ink is wicked at a desired rate but not so low that the ink will puddle when it first contacts the substrate. Typically inks designed for inkjet application have relatively low viscosities and are not suitable for stamp pad use. A sixth issue is the inclusion of polymer components where the polymer can soften and adhere to the decorated item. A seventh issue particularly related to inkjet inks is the inclusion of certain specialty chemicals necessary for proper long-term operation of ink jet pens but not required or desired for the disclosed application. An eighth issue is the percentage of water in the composition. It is desirable for the ink to be primarily aqueous based, but this is not the case with most industrial use inkjet inks. It should be readily apparent that for broad consumer use, especially with children, the chemical composition criteria of the sublimation inks will necessarily be more stringent than for commercial or industrial inkjet sublimation inks.

Rubber stamp pads are commonly used by the craft industry for diverse decorating applications. A typical construction would include a pad to hold the specific ink and an image-based rubber applicator. The applicator is inked, and the image transferred to a surface such as paper, plastic, wood, etc. Requirements for the ink fluid would include suitable fluidity, ability to adhere to the rubber surface but be easily released from the surface, and resistance to premature drying. In addition, the ink must be environmentally friendly and have limited or no volatile organic compounds. Additional safety issues would apply when the ink is to be used by children.

Stamp pad inks fluids are usually based on water with limited use of water miscible solvents such as alcohols and glycerin. The colorant is usually a dye that is soluble in the fluid system. Additional components could include surfactants to adjust viscosity and biocides to prevent mold. Pigment-based stamp pad inks are also known where improved light stability is desired and for those inks a pigment dispersant is probably required. Disperse or sublimation inks would have the characteristics of pigment inks where the disperse dye is insoluble in the fluid matrix.

A pending application from the same inventors describes specific sublimation dye-based inks for use in nib-based markers. While those compositions are suitable for use in marking pens, they must be modified for use in stamp pads. Specifically, higher ink viscosities are necessary to prevent ink drying and this is accomplished by appropriate concentrations of water-miscible cosolvents such as glycerin or propylene glycol as well

as suitable surfactants. Wetting agents are also useful for adhesion of the ink to the rubber stamp portion. The specific dye concentration may be less than for typical ink jet inks as the higher stamp pad ink viscosity results in higher ink lay down on a substrate.

Preparation of the stamp pad inks is similar to that mentioned in pending application for the sublimation markers. The disperse dye is typically milled with a type and quantity of water and dispersant required to produce a particle size dispersion that once combined with additional ink components will provide a dye dispersion that will remain in a stable dispersed form for an extensive time period even under varying environmental conditions. The preferred average particle will be in the 5 to 200 nm size range. The particular technique used to mill the dye particles can be one common to the pigment milling industry and could include (for example) ball mills, attritors, or continuous media mills. The invention is not limited to specific disperse dyes and could include ones that are typically used to decorate textile fibers or coated novelty items. Preferably the dyes are free of impurities and toxic components and are environmentally friendly. It is preferred that the particular dyes pass an AMES test for potential mutagenicity. Within the scope of this invention is the option for having the dye particles encapsulated in a polymer. The quantity and type of dispersant will depend on the specific disperse dye and could range (typically) from 0.5 to 50% of the weight of pigment. The specific dispersant is limited only to one that provides the desired pigment dispersion stability and could include such materials (for example) as polymeric acrylic acids, ethoxylated compounds, block and graft polymers, and sulfonate compounds. Additional ink components could be included during the process of preparing the dye dispersion or alternatively added during dilution of the dispersion.

The above dispersion is then diluted with water, co-solvents and additional ink components such that the final dye concentration will be in the 1 to 10%, depending on the particular dye and its tinctorial strength. The final concentration of water is 30 to 60% of the total ink. A secondary water-miscible solvent or mixture of solvents is used to reduce evaporation and prevent premature ink drying. The total quantity of water-miscible co-solvents is typically in the 40 – 70% range. Examples of suitable co-solvents include alcohols, glycols, glycerin, and pyrrolidine. The ink may also include additional components such as pH adjusters, surfactants, biocides, viscosity modifiers, defoamers and light stabilizers.

An example of a composition usable for stamp pad sublimation would include components in the following ranges:

Dye	2-10%
Dispersant	0-5%
Propylene Glycol	0-30%
Glycerin	0-25%
Polyethylene Glycol	0-14%
Aquazol	0-4%
Miscellaneous	0-5%

Additional Inventors being named on Patent application titled:

Dye Sublimation Ink Composition and Process for use with Pad Printers

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